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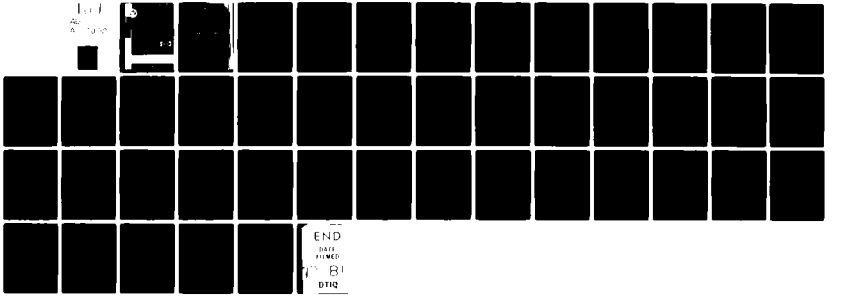

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CONCEPTUAL DEVELOPMENT OF A [illegible]
LSO CARRIER LANDING TRAINING AID

Clyde A. Bristom
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La Jolla, California 92037

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Carrier Landing Training	Knowledge of Results (KOR)
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Field Carrier Landing Practice (FCLP)	

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

A conceptual plan designed to aid the Landing Signal Officer (LSO) in training pilot carrier landing skills is described. The plan, named the Automated Performance Assessment and Remedial Training System (APARTS) employs basic principles of learning in integrating the Night Carrier Landing Trainer (NCLT) with Field Carrier Landing Practice (FCLP). Application of the APARTS conceptual plan resulted in the development of two computer programs, PADDLES and GRADER, which are described and documented.

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The two computer programs process, store and summarize LSO grades and comments of a pilot's landing performance during FCLP. Individualized training is accomplished through diagnostic training feedback provided by program printouts. NCLT remedial instruction is specified to correct a pilot's landing technique problems identified during FCLP. Future development and integration of APARTS for improved carrier landing training effectiveness is outlined.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SECTION I

BACKGROUND

In 1978, a report on A7 training effectiveness concluded that certain improvements could be made in training Category I replacement pilots (RP) how to acquire night carrier landing skills.[1] An important aspect of the study was a training method which emphasized individualized remedial instruction in the Night Carrier Landing Trainer (NCLT). Individualized pilot instruction in the NCLT resulted in a reduction of costly recycle training and an improvement in overall pilot performance during Carrier Qualification (CQ) trials. The study was part of a continuing program of research designed to improve training methods and make more effective use of simulators such as the NCLT. Previous research has reported on the positive transfer of training from the NCLT to actual A7E carrier qualification.[2]

The remedial instruction technique described in the 1978 study utilized a manual system to identify what remedial NCLT instruction each RP required to enhance night landing skills. Specifically, the manual system consisted of the following steps:

1. Analyze each pilot's field carrier landing practice (FCLP) performance to identify pilot landing technique problems.
2. Provide diagnostic training feedback to each pilot on his FCLP results.
3. Translate diagnostic training information into remedial training objectives that can be accomplished in the NCLT.
4. Provide remedial NCLT instruction before the next night FCLP period.

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[1]Brictson, C.A. A7 Training Effectiveness Through Performance Analysis. Orlando, Florida: NAVTRAEQUIPCEN 75-C-0105-1, April 1978.

[2]Brictson, C.A. and Burger, W.J. Transfer of Training Effectiveness: A7E Night Carrier Landing Trainer (NCLT) Device 2F103. Orlando, Florida: NAVTRAEQUIPCEN 74-C-0079-1, August 1976.

5. Repeat steps 1-4 for at least the first five successive night FCLP periods.

Since 10 to 12 pilots usually were involved in each FCLP period, up to 120 landings per period (10 per pilot) had to be monitored, logged, and debriefed by the LSO's in charge. The magnitude of paperwork generated by this process suggested that an automated system would be preferable to the present manual system to ease LSO workload. Further, an automated system would provide pilots with immediate knowledge of results and would make training more compatible with the Aviation Training Support System (ATSS). The ATSS is currently under development to automate other parts of the pilot readiness training program and eventually will incorporate carrier landing training.

On the basis of the promising results attained, the Naval Training Equipment Center (NAVTRAEQUIPCEN) decided to support the development of an automated LSO training aid which would analyze FCLP performance and tailor NCLT remedial instruction to each novice pilot. Preliminary results are documented in this report. The system, as it evolved, became known as APARTS (Automated Performance Assessment and Remedial Training System).

SECTION II

APARTS CONCEPTUAL DEVELOPMENT

APARTS is an automated training system designed to assist LSO's in the instruction of pilot carrier landing skills. The APARTS emphasizes individualized instruction and utilizes the following psychological principles of learning.

- Meaningful organization of information,
- Problem analysis,
- Immediate knowledge of results (KOR), and
- Remedial instruction.

The conceptualization of APARTS begins with established learning principles which are mediated through automated programs and result in program outputs which provide pilot training feedback. Figure 1 presents the conceptualization of APARTS as related to the NCLT/FCLP stage of carrier landing training. Three key features of APARTS which distinguish the system from current carrier landing training are: a) APARTS is based upon a few well-established principles of learning; b) the system is an automated training aid to assist (not replace) the LSO in improving pilot performance and reducing LSO workload; and c) the system integrates NCLT training with FCLP by providing individualized remedial instruction.

APARTS integrates NCLT with FCLP training in the following manner:

1. FCLP performance data are organized by pilot into a meaningful format which is called a FCLP Trend Analysis Form. This form is used and accepted in the fleet and categorizes LSO landing comments into <u>type</u> of comment (glideslope, speed, etc.) and <u>location</u> of comment (all the way, in close, at the ramp, etc.). The form represents a meaningful format to summarize LSO landing comments for each night FCLP period.
2. FCLP performance data are analyzed to identify landing technique problems unique to each pilot.

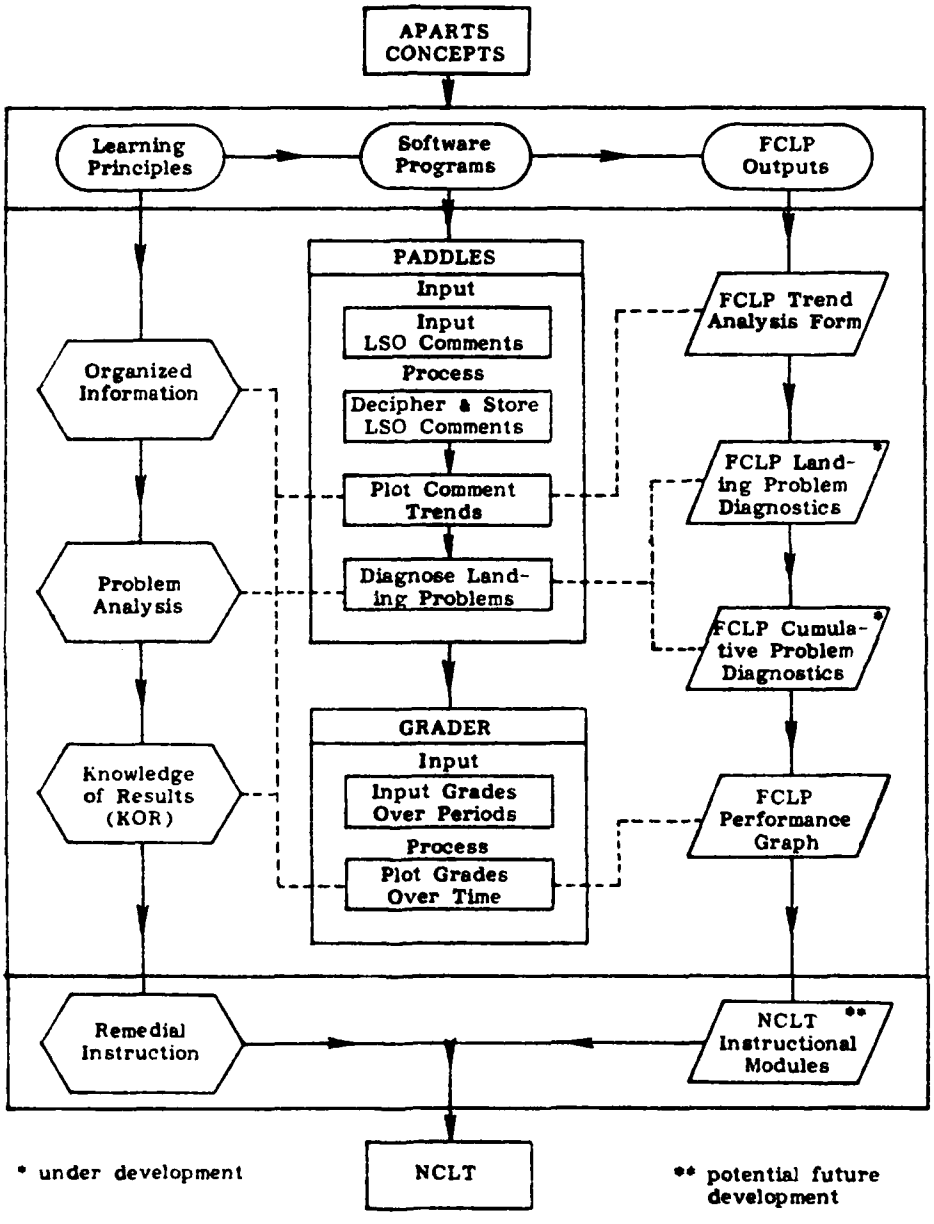

Figure 1. Conceptualization of APARTS as related to FCLP and NCLT stages of carrier landing training.

3. The organized comments and problem areas are given to the student pilots for immediate KOR.
4. LSO's decide what remedial instruction shall be given in the NCLT prior to the next night FCLP period. Thus, each pilot receives individual instruction on specific landing problems as identified by the LSO from the FCLP Trend Analysis Form.
5. The system repeats the cycle after each night FCLP period.

In brief, APARTS is designed to utilize LSO information about a pilot's FCLP performance in a manner which will identify problems, provide diagnostic feedback, and result in NCLT remedial training to improve landing performance.

SECTION III

APARTS SOFTWARE PROGRAM DESCRIPTION

Two computer software programs were developed to process, store, compile, summarize, and combine FCLP performance data. The current capabilities of the two programs called PADDLES and GRADER are described and reviewed in this section to show how each program processes information and provides outputs to facilitate individualized remedial instruction.

PADDLES[3]

PADDLES is a computer program which analyzes and assesses replacement pilot FCLP performance data during carrier landing training. Input to the Fortran IV-written PADDLES program consists of LSO grades and comments for a maximum of 12 student pilot landings per pilot within a single FCLP period. This information, as well as pilot identification data, is transcribed from data recorded by an LSO on the FCLP Grade Form (see Figure 2) and entered manually on a computer terminal. PADDLES outputs are:

1) FCLP Trend Analysis Form
2) FCLP Landing Problem Diagnostics (under development)
3) FCLP Cummulative Problem Diagnostics (under development)

Once LSO comment data have been entered into the computer, PADDLES deciphers the comments to determine the general types and location of pilot landing problems. Following this assessment, PADDLES produces output on the terminal which consists, in part, of an FCLP Trend Analysis Form. An example of the FCLP Trend Analysis Form is presented in Figure 3. All LSO

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[3]PADDLES: An Automated Performance Tabulation and Analysis of Field Carrier Landing Practice (FCLP)--Preliminary Operator Instruction. La Jolla, California: Dunlap and Associates, Inc., November 1978.

FCLP Grade Form

FCLP

Lowman 500

Name A/C

Date: D (N) HOP # 3

1.	(OK)	HAW COTL
2.	(OK)	NEPSIC (LOAR)
3.	B→	NERDIM OC(TMRDIC)XTAR
4.	—	HAW EGTL
5.	B→	OCSRDFIM NEPIC XTAR
6.	(OK)	NEPIC CDAR
7.	(OK)	COXHFIM NEPCDIC
8.	(ok)	NEPSIM
9.	—	HXTMRDIM OCSIC
10.	(ok)	DEC.IM TMRDIC
11.		
12.		

Comments: Avg.

LSO: Instructor

Figure 2. Example of PADDLES input: FCLP Grade Form.*

*A glossary of LSO comments is included in Appendix C.

FCLP TREND ANALYSIS FORM PILOT: [illegible]

LSO: INSTRUCTOR

DATE: DAY/NITE: NIGHT FCLP NO: 4 ACFT TYPE/SIDE #: A-7E /500 SQUADRON:

		GLIDESLOPE AND SPEED ERRORS						CONTROL ERRORS		LINEUP & WINGS	REMARKS
LDG#	GRD	AM	OT	X	IM	IC	AR	POWER	ATTITUDE		
1.	(OK)	H									FOTL
2.	(OK)					S	(LO)	NEPIC			
3.	P>				NERD	OC(TMRD)	\>				
4.	--	H						EGTL			
5.	B>				OCSRDF		\>	_NEPIC_			
6.	(OK)						CD	NEPIC			
7.	(OK)				HF	CD		COX NEPIC			
8.	(OK)				S			NEPIM			
9.	--			H	TMRD	OCS					
10.	(OK)				DEC	TMRD					

AVERAGE GRADE: 2.70 FOR 10 LANDINGS.

RECOMMENDED NCLT ACTION:

POWER MANAGEMENT TRAINING IN NCLT TO IMPROVE GLIDESLOPE CONTROL. INSTRUCT IN HOW TO ANTICIPATE POWER CORRECTIONS WITH NARROWING FRESNEL GLIDESLOPE ENVELOPE.

SIGNED: LSO

Figure 3. Example of PADDLES output: FCLP Trend Analysis Form.

grades and comments for a pilot's FCLP performance during a single period are shown. When presented this way, these data indicate to the LSO and the pilot, general landing technique trends. Data presented on the FCLP Trend Analysis Form is but one method of providing immediate and meaningful performance feedback. Additionally, an average LSO grade for the entire FCLP period is also displayed on the FCLP Trend Analysis Form. Not only is the calculation of average grades much faster by computer than hand calculations, but it is also much more accurate.

Another output of the PADDLES program is the FCLP Landing Problem Diagnostics. This output provides more specific error analysis and performance feedback to the user than the FCLP Trend Analysis Form. In particular, the summary describes in detail the type, frequency and location of pilot landing errors. An example of a preliminary version of the FCLP Landing Problem Diagnostics is presented in Figure 4. The diagnostics are weighted summaries of LSO comments which can be used to assist LSOs in determining specific NCLT remedial action. In this preliminary version of the diagnostics, the first two areas, general landing technique problems and landing segments, provide specific information on problem areas. These two areas are summarized in the third section--specific landing technique problems and location. In this example, LSO comments are weighted and combined to show the percentage of total landing difficulties at any particular landing segment. The diagnostics are in a preliminary stage of development and undergoing more research refinement to make the final version more usuable for the LSO community. They are presented here for illustration only.

After FCLP data are analyzed by PADDLES, an LSO assesses pilot performance and recommends specific remedial instruction on the NCLT. This process is now manually performed by LSO's. In the example (Figure 3), the LSO recommended action is for NCLT remedial training in power management.

PADDLES structures the training so that each RP receives individualized instruction on problems diagnosed from FCLP performance data. Further, since the instruction is individualized and remedial, different rates of learning

```
- - - - - - - *****   LANDING PROBLEM DIAGNOSTICS   ***** - - - - - - -

 ** DIAGNOSTICS ARE WEIGHTED SUMMARIES OF LSO' COMMENTS **

GENERAL LANDING TECHNIQUE PROBLEM AREAS:
  [23.6%]>(13) -   GLIDESLOPE CONTROL
                     (12)- TOO HIGH;    ( 1)- TOO LOW
  [38.2%]>(21) -   RATE OF DESCENT
                     (17)- TOO MUCH;    ( 4)- NOT ENOUGH
  [10.9%]>( 6) -   SPEED CONTROL
                     ( 4)- TOO FAST;    ( 2)- TOO SLOW
  [27.3%]>(15) -   POWER MANAGEMENT
                     ( 2)- TOO MUCH;    (13)- NOT ENOUGH

LANDING SEGMENTS SHOWING GENERAL DIFFICULTY:
  [32.7%]>(18) -   IN MIDDLE THIRD OF GLIDESLOPE
  [32.7%]>(18) -   IN CLOSE (LAST THIRD OF GLIDESLOPE)
  [12.7%]>( 7) -   AT THE RAMP

SPECIFIC LANDING TECHNIQUE PROBLEMS AND LOCATIONS IN LANDING SEQUENCE:

      ***          GLIDESLOPE CONTROL
  [ 9.1%]>( 5)*    AT THE RAMP
                     ( 4)- TOO HIGH;    ( 1)- TOO LOW

      ***          RATE OF DESCENT
  [14.5%]>( 8)*    IN MIDDLE THIRD OF GLIDESLOPE
                     ( 4)- TOO MUCH;    ( 4)- NOT ENOUGH
  [16.4%]>( 9)*    IN CLOSE (LAST THIRD OF GLIDESLOPE)
                     ( 9)- TOO MUCH;    ( 0)- NOT ENOUGH

      ***          SPEED CONTROL
  [10.9%]>( 6)*    IN MIDDLE THIRD OF GLIDESLOPE
                     ( 4)- TOO FAST;    ( 2)- TOO SLOW

      ***          POWER MANAGEMENT
  [16.4%]>( 9)*    IN CLOSE (LAST THIRD OF GLIDESLOPE)
                     ( 0)- TOO MUCH;    ( 9)- NOT ENOUGH
```

Figure 4. Example of PADDLES output: FCLP Landing Problem Diagnostics.

among RP's can be taken into account. For example, if a pilot has a problem with high starts or power control difficulties, correction of these particular problems would be emphasized during remedial NCLT trials. A key to this method of training is that landing problems identified during night FCLP can be corrected by remedial training in the NCLT--prior to the next FCLP period. Hence, the pilot would receive supplemental instruction in how to correct landing problems diagnosed from the previous FCLP. Since individual pilot problem areas are emphasized during remedial instruction, it may be possible in the future to identify a set of generic landing problems encountered by A7 replacement pilots and what types of corrective procedures (in the form of instructional modules) should be provided on the NCLT.

PADDLES is a program of APARTS which assesses and documents a pilot's performance for up to 12 aircraft approaches during a single FCLP period. An extension of this logic is to summarize, in a cumulative manner, a pilot's performance over several successive FCLP periods. Future software development will stress and provide this capability so that pilot landing problems can be analyzed and detected over time to provide a longitudinal performance summary of each pilots training progress and also an indication of remedial training results.

GRADER

The PADDLES program of APARTS primarily focuses on the analysis of LSO comments. GRADER is a program designed to provide information of a pilot's rate of learning in the form of an FCLP learning curve. Average grades for each FCLP period are entered manually on a terminal as inputs to the Fortran IV-written computer program called GRADER. The output of this program is an FCLP Performance Graph. An example of the FCLP Performance Graph is presented in Figure 5. The FCLP Performance Graph is a summary of pilot performance across day and night FCLP periods. An LSO may be able to use the performance graph as a learning acquisition curve or to detect potential recycle pilots (those pilots who fail CQ and must be

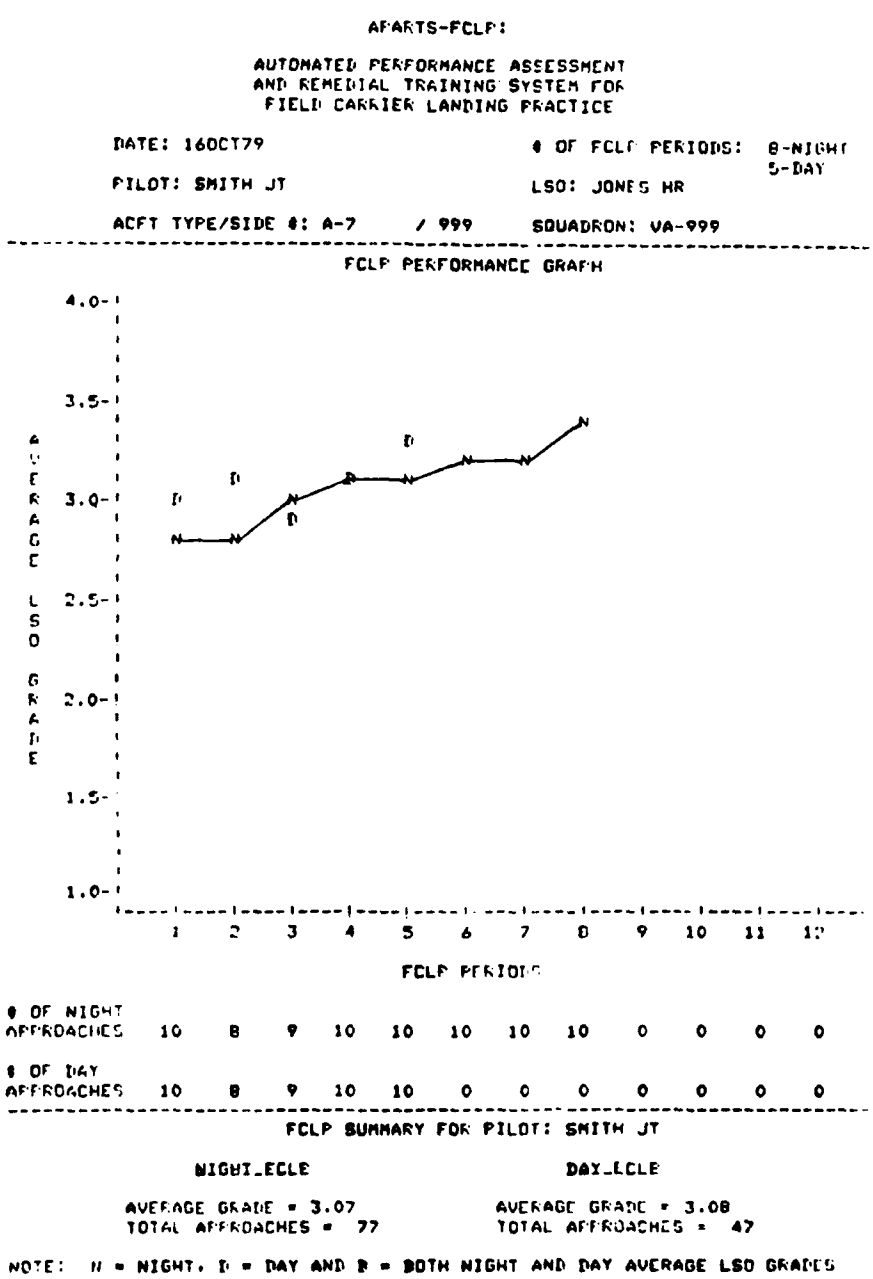


Figure 5. Example of GRADER Output: FCLP Performance Graph.

retrained). This may be especially useful during early FCLP periods so that erratic or low performance can be identified. Documentation for the computer program GRADER is presented in Appendix A with operator instruction presented in Appendix B.

SECTION IV

FUTURE APARTS DEVELOPMENT

Continued development and eventual implementation of APARTS as a carrier landing training aid for LSO's could provide improvements to the pilot carrier landing training sequence in the following areas:

- Individualized Training Effectiveness in Fleet Readiness Squadron (FRS) and Fleet through:
  - Meaningful organization of material
  - Problem analysis
  - Immediate knowledge of results identifying specific landing problems
  - NCLT remedial instruction
- CQ Landing Performance Measurement to develop:
  - FRS CQ performance training data bank
  - FRS CQ performance standards
  - FRS CQ training progress assessment and validation
- Fleet Carrier Landing Performance Measurement for:
  - Fleet landing performance data bank
  - Fleet landing norms
  - Fleet landing proficiency index
- Administrative Efficiency in:
  - Reduced LSO workload
  - Reduced time and cost through automated data storage and retrieval
  - ATSS integration
  - NCLT instructional modules

Planned developments within specific topics are outlined below.

APARTS Individualized Training Effectiveness

APARTS as conceptualized and currently developed promises to apply general principles of learning to accomplish individualized training effectiveness in the A7 FRS community as well as fleet operations. As described in this report, APARTS would identify landing technique problems unique to each novice pilot and provide remedial training to correct the problem and enhance performance through increased NCLT training. While this training sequence is appropriate for the FRS by its access to the NCLT, fleet operations could also be tabulated and evaluated by APARTS to identify landing trends for fleet qualified pilots. Remediation in these cases could be accomplished through a review of APARTS data for each individual over time (line period, cruise, yearly) or through their use of an NCLT. Current research at NAVTRAEQUIPCEN is investigating a portable and general purpose NCLT for use on carriers. Should this design prove feasible, shipboard NCLT training could be used to enhance pilot landing proficiency.

At present, APARTS conceptual framework has focused on the NCLT/FCLP stage of Phase III carrier landing training. However, since LSO comments are recorded during actual carrier landings, APARTS could easily be adapted for carrier qualification training and fleet recovery operations.

APARTS Related to CQ Training

APARTS as utilized for carrier qualification training would require only minor modification to the present outputs. LSO grades and comments on pilot performance would be documented to provide pilots with diagnostic feedback of day and night recovery trends. A CQ performance graph would replace the FCLP graph. Computerization of the CQ data would allow automation of such administrative forms as the CQ completion letter. In addition, the compilation of CQ LSO comments on a CQ landing trend form might increase fleet LSO acceptance and use of FRS CQ data for training.

Since the ultimate purpose of A7 CQ training is carrier landing, the collection of CQ data would be the first step in developing a performance data bank for use in validating, assessing and improving FRS training effectiveness.

APARTS Related to Fleet Operations

APARTS could also be used for fleet operations by processing LSO grades and comments of pilot carrier landing approaches. Through automated data storage and retrieval of diagnostic information, fleet pilots could be better appraised of their carrier landing performance over time. The performance data could be automatically stored and used to determine the extent to which carrier landing skills deteriorate or are retained by pilots under different operational conditions. Finally, night carrier landing performance norms could be established to compare carrier recovery proficiency across different ships, aircrafts, squadrons and individual pilots. Normative data could also be used to determine relative levels of pilot landing proficiency.

APARTS Integration with ATSS

Future APARTS applications should also involve the integration of APARTS with the automated ATSS. If APARTS is to be implemented at A7 FRS squadrons, it is recommended that the PADDLES and GRADER programs be converted to BASIC computer language to make APARTS compatible with ATSS. Program modifications could be made to automate PADDLES outputs so that data could be obtained not only via printouts, but additionally, be stored on computer media such as tape or disk. This step would greatly enhance APARTS utility and storage capability and eliminate the need for manual data input to the GRADER program.

APARTS-NCLT Instructional Modules

Future research should be performed to develop instructional modules for the NCLT so that when a certain problem occurs during FCLP, a special module would be provided to correct the problem. Research currently under investigation includes the development of a generic set of landing problems unique to the novice A7 pilot. Over 2,000 night FCLP trials, along with RP questionnaire data and LSO subject matter expert information, are being reviewed and analyzed to identify typical landing problems encountered during FCLP training. Once identified, it should be possible to revise the curriculum to emphasize correction of these frequently occurring problems. In addition, formal and structured NCLT modes of instruction could be developed and incorporated into NCLT training to standardize the remedial instruction provided for each set of landing technique problems. The feasibility of identifying landing problems as a function of novice pilots and aircraft type has already been verified through one field study of FCLP performance and promises to improve overall A7 training effectiveness.

APPENDIX A

DOCUMENTATION OF GRADER COMPUTER PROGRAM

```
      PROGRAM PRNT(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
      DIMENSION ITAB(31,13),FERT(12),NTAPP(12),NDAPP(12)
      INTEGER*2 IN,NAME,NDR,NUP,N
      DATA DEM,BLANK,SCOREN,SCOR3/10*8H         ,1H ,1HN,1HD/
      DATA FMEC /30TH/1H7,1H8/
C ***********************************************************
C **                                                       **
C **  ARTS-FCLP: AUTOMATED PERFORMANCE ASSESSMENT          **
C **             AND REMEDIAL TRAINING SYSTEM              **
C **             FOR FIELD CARRIER LANDING PRACTICE        **
C **                                                       **
C ** WRITTEN FOR: NTEC - ORLANDO, FLORIDA                  **
C ** WRITTEN BY: DUNLAP AND ASSOCIATES, INC.               **
C **             WESTERN DIVISION                          **
C **             LA JOLLA, CALIFORNIA  92037               **
C ** PROGRAMMER: DR. STEVEN T. BREIDENBACH                 **
C **             ASSOCIATE SCIENTIST                       **
C ** DATE: AUGUST, 1979                                    **
C **                                                       **
C ** HARDWARE: PDP-11/40, MICRO-1 WITH 48K MEMORY          **
C **           2 RX01 DEC/PM-XS11 FLOPPY DISC DRIVES       **
C **           DECWRITER II TERMINAL                       **
C ** OPERATING SYSTEM SOFTWARE: DEC RT-11 VERSION 02       **
C ** FORTRAN COMPILER: VERSION 01                          **
C **                                                       **
C ** INPUTS - FCLP PROGRAM INPUT: DEMOGRAPHIC DATA,        **
C **                              AVERAGE FCLP GRADES &    **
C **                              # OF APPROACHES FOR UP   **
C **                              TO 10 NIGHT, 11 DAY OR   **
C **                              12 NIGHT AND 12 DAY      **
C **                              FCLP PERIODS             **
C **                                                       **
C ** GRAPHIC FCLP PERFORMANCE (OPTION): PERFORMANCE GRAPH   **
C **                                DEPICTING A PILOT'S    **
C **                                PERFORMANCE OVER       **
C **                                SUCCESSIVE FCLP        **
C **                                PERIODS                **
C **                                                       **
C ***********************************************************
      TYPE 1000
 1000 FORMAT (' WELCOME TO ARTS-FCLP, AN AUTOMATED PERFORMANCE ASSE
     *SSMENT AND REMEDIAL TRAINING SYSTEM FOR FIELD CARRIER LANDIN
     *G PRACTICE.')
C  CONTINUE
      DO 15 I=1,12
       0 = 0.0
```

Figure A-1. GRADER Computer Program (Sheet 1 of 5).

```
      14 XMAT(I,J) = 2L-M
         NNAPP(I) =0
         NDAPP(I) =0
         PERIOD(I)=0.0
      15 CONTINUE
         TYPE 100
  100 FORMAT (
          TYPE '(A)'
      2 FORMAT (' ENTER STUDENT PILOT''S LAST NAME AND INITIALS.')
         ACCEPT 103,(DEM(I),I=2,4)
  103 FORMAT (3A8)
         TYPE 1004
 1004 FORMAT (' ENTER AIRCRAFT TYPE.  EX: A-4L')
         ACCEPT 1005,DEM(8)
 1005 FORMAT (A8)
         TYPE 1006
 1006 FORMAT (' ENTER AIRCRAFT SIDE #.  EX: 312')
         ACCEPT 1007,DEM(9)
 1007 FORMAT (A8)
         TYPE 1008
 1008 FORMAT (' ENTER TODAY''S DATE.  EX: 28AUG79 OR 08/28/79')
         ACCEPT 1009,DEM(6)
 1009 FORMAT (A8)
         TYPE 1010
 1010 FORMAT ('     ENTER SQUADRON.  EX: VA-174')
         ACCEPT 1011,DEM(10)
 1011 FORMAT (A8)
         TYPE 1012
 1012 FORMAT ('     ENTER LSO''S LAST NAME AND INITIALS.')
         ACCEPT 1013,(DEM(I),I=5,7)
 1013 FORMAT (3A8)
         TYPE 1016,(DEM(I),I=1,10)
 1016 FORMAT (' '/'0YOU HAVE ENTERED THE FOLLOWING INFORMATION: '//' DATE: '
     *,A8/' PILOT: ',3A8/' LSO: ',3A8/' ACFT TYPE: ',A8/' ACFT SIDE #:
     2,A8   /' SQUADRON: ',A8)
         TYPE 1017
 1017 FORMAT (' '/' IF THE ABOVE INFORMATION IS CORRECT, ENTER Y.  IF NOT, E
         NTER N.')
         ACCEPT 1018,STATUS
 1018 FORMAT (A1)
         IF (STATUS.EQ.'CHECK') GO TO 20
         TYPE 1019
 1019 FORMAT ('0PLEASE, RE-ENTER ALL INFORMATION.')
         GO TO 10
   20 CONTINUE
         VNP=0
```

Figure A-1. GRADER Computer Program (Sheet 2 of 5).

```
      SUMN=0.0
      XMEAN=0.0
      ENCODE(1,1050,CHECK)
      TYPE 1060
1060  FORMAT ('DO YOU WISH TO ENTER AVERAGE GRADES'/' FOR NIGHT FCLP PE
     *RIODS'/' IF YOU DO, ENTER Y.  IF NOT, ENTER N.')
      ACCEPT 1061,STATUS
1061  FORMAT (A1)
      IF (STATUS.NE.CHECK) GO TO 71
      GO TO 1014
1014  FORMAT ('0ENTER THE NUMBER OF NIGHT FCLP PERIODS.')
      ACCEPT 1015,NNP
1015  FORMAT(I2)
      TYPE 1020
1020  FORMAT ('0ENTER THE AVERAGE GRADE FOR EACH FCLP'/
     *' PERIOD EXACTLY AS IT APPEARS ON THE'/
     *' FCLP TREND ANALYSIS FORM.'/
     *' I.E.  - DATA SHOULD BE IN X.XX FORMAT.')
      PN=NNP
      INN=1
   30 CONTINUE
      TYPE 1021,INN
1021  FORMAT ('0ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD # ',I2)
      ACCEPT 1022,PERIOD(INN)
1022  FORMAT (F3.2)
      TYPE 1023,INN
1023  FORMAT (' ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD # ',I2)
      ACCEPT 1024,NNAPP(INN)
1024  FORMAT (I2)
      NNAPPS=NNAPPS+NNAPP(INN)
      SUMN=SUMN+PERIOD(INN)
      IF (INN.GE.NNP) GO TO 40
      INN=INN+1
      GO TO 30
   40 CONTINUE
      XMEANN=SUMN/PN
      DO 70 K=1,NNP
      NNR=(PERIOD(K)+.05)*10.0
      INNR=41-NNR
      XMAT(INNR,N)=SCORE(N)
   70 CONTINUE
   71 SUMD=0.0
      NDOF=0.0
      XMEAND=0.0
      SUMP=0
```

Figure A-1. GRADER Computer Program (Sheet 3 of 5).

```
      DO 70 I=1,12
      PERIOD(I)=0.0
   70 CONTINUE
      TYPE 10,5
 1025 FORMAT ('0DO YOU WISH TO ENTER AVERAGE GRADES'/' FOR DAY FCLP PERI
     * ODS? ',' IF YOU DO, ENTER Y.  IF NOT, ENTER N.')
      ACCEPT 1026,STATUS
 1026 FORMAT (A1)
      IF (STATUS.NE.CHECK) GO TO 120
      TYPE 1027
 1027 FORMAT ('0ENTER THE # OF DAY FCLP PERIODS')
      ACCEPT 1028,NDP
  120 FORMAT (I2)
      TYPE 1020
      IND=NDP
      IND=1
   80 CONTINUE
      TYPE 1029, IND
 1029 FORMAT ('0ENTER THE AVERAGE GRADE FOR DAY PERIOD # ',I2)
      ACCEPT 1030,PERIOD(IND)
 1030 FORMAT (F4.2)
      TYPE 1031,IND
 1031 FORMAT (' ENTER THE # OF APPROACHES FOR DAY FCLP PERIOD # ',I2)
      ACCEPT 1032,NDAPP(IND)
 1032 FORMAT (I2)
      NDAPPS=NDAPPS+NDAPP(IND)
      SUMD=SUMD+PERIOD(IND)
      IF (IND.GE.NDP) GO TO 90
      IND=IND+1
      GO TO 80
   90 CONTINUE
      XMEAND=SUMD/PD
  105 DO 110 L=1,NDP
      NDR=(PERIOD(L)+.05)*10.0
      INDR=41-NDR
      IF (XMAT(INDR,L).EQ.BLANK) GO TO 109
      XMAT(INDR,L)=BOTH
      GO TO 110
  109 XMAT(INDR,L)=SCORED
  110 CONTINUE
  200 CONTINUE
      TYPE 2000
 2000 FORMAT ('0HOW MANY COPIES OF THE OUTPUT DO YOU WANT?')
      ACCEPT 2001,NCOP
```

Figure A-1. GRADER Computer Program (Sheet 4 of 5).

```
2091 FORMAT (I2)
     IF (NCOP.EQ.0) GO TO 5000
     DO 130 M=1,NCOP
     TYPE 1033,DEM(J),NNP,NDP,(DEM(I),I=2,10)
1033 FORMAT (1H1/T38,'APARTS-FCLP:'//T28,'AUTOMATED PERFORMANCE ASSESSM
    *ENT'/T28,'AND REMEDIAL TRAINING SYSTEM FOR'/T29,'FIELD CARRIER LAN
    *DING PRACTICE'//T16,'DATE: ',A8,T52,'# OF FCLP PERIODS: ',I2,'-NIG
    *HT ',T71,I2,' DAY'/T16,'PILOT: ',3A8,T52,'LSO: ',3A8//T16,'ACFT TYP
    *E/SIDE #: ',A8,'/ ',A8,'SQUADRON: ',A8)
     TYPE 1034
1034 FORMAT (T7,74('-')/T36,'FCLP PERFORMANCE GRAPH'/)
     TYPE 1035,((XMAT(I,J),J=1,12),I=1,31)
1035 FORMAT (T12,'4.0-!',12(4X,A1)/4(T16,'!',12(4X,A1)/),T12,'3.5-!',12
    *(4X,A1)/T16,'!',12(4X,A1)/T9,'A      !',12(4X,A1)/T9,'V      !',12
    *(4X,A1)/T9,'E      !',12(4X,A1)/
    *T9,'R  3.0-!',12(4X,A1)/T9,'A      !',
    *12(4X,A1)/T9,'G      !',12(4X,A1)/T9,'E      !',12(4X,A1)/T16,'!',
    *12(4X,A1)/T9,'L  2.5-!',12(4X,A1)/T9,'S      !',12(4X,A1)/T9,'O
    *   !',12(4X,A1)/T16,'!',12(4X,A1)/T9,'G      !',12(4X,A1)/T9,'R  2
    *.0-!',12(4X,A1)/T9,'A      !',12(4X,A1)/T9,'E      !',12(4X,A1)/T9
    *,'E      !',12(4X,A1)/T16,'!',12(4X,A1)/T12,'1.5-!',12(4X,A1)/4(T1
    *6,'!',12(4X,A1)/),T12,'1.0-!',12(4X,A1)/
     TYPE 1036,(NNAPP(I),I=1,12),(NDAPP(J),J=1,12)
1036 FORMAT (T16,13('!---')/T21,'1',T26,'2',T31,'3',T36,'4',T41,'5',T4
    *6,'6',T51,'7',T56,'8',T61,'9',T65,'10',T70,'11',T75,'12'//,T
    *41,'FCLP PERIODS'//T7,'# OF NIGHT'/T7,'APPROACHES',12(3X,I2)/T7,'
    *# OF DAY'/T7,'APPROACHES',12(3X,I2)/T7,74('-'))
     TYPE 1037,(DEM(I),I=2,4)
1037 FORMAT (T31,'FCLP SUMMARY FOR PILOT: ',3A8//T23,'NIGHT FCLP',T55,'
    *DAY FCLP')
     TYPE 1038,XMEANN,XMEAND,NNAPPS,NDAPPS
1038 FORMAT (' ',T23,10('_'),T55,8('_')//T17,'AVERAGE GRADE = ',F4.2,T4
    *9,'AVERAGE GRADE = ',F4.2/T17,'TOTAL APPROACHES = ',I3,T49,'TOTAL
    *APPROACHES = ',I3//T7,'NOTE:  N = NIGHT, D = DAY AND B = BOTH NIGH
    *T AND DAY AVERAGE LSO GRADES')
 130 CONTINUE
     TYPE 1039
1039 FORMAT ('1DO YOU WISH TO ENTER DATA FOR ANY MORE STUDENTS?'/' IF Y
    *OU DO, ENTER Y.  IF NOT, ENTER N.')
     ACCEPT 1040,STATUS
1040 FORMAT (A1)
     IF (STATUS.EQ.CHECK) GO TO 10
5000 STOP
     END
```

Figure A-1. GRADER Computer Program (Sheet 5 of 5).

APPENDIX B

OPERATOR INSTRUCTIONS FOR GRADER COMPUTER PROGRAM

GRADER was designed to summarize and plot student pilot performance over successive day, night or both day and night FCLP periods. All information required as input to this computer program is recorded on printouts from the PADDLES program.

Prior to input of any data, the GRADER program must first be called up on the computer. This procedure will vary depending upon the type of equipment used; nevertheless, the program should run on any computer with a Fortran compiler.

Once GRADER is running, the program will prompt the operator for specific information and wait for appropriate input. Identification information is accepted as free-format data so the program will not make any attempt to verify or correct what has been entered. If information is entered wrong, at the wrong point, or not at all, it will be recorded as such on the printed output. Moderate care should be taken to ensure that the correct information is entered at the correct point.

After all identifiers have been entered, the program will display the information to the operator and ask for confirmation. If the operator is satisfied with the information, "Y" (yes) should be typed and the program will continue. If corrections are required, typing "N" (no) will re-start the data entry sequence, and all identification information must be re-entered.

Following the verification of identification data the program requests whether the operator wishes to enter average grades for night FCLP periods. The operator must respond with a "Y" for yes or "N" for no. If answered yes, the program requests the number of night periods. After entering the number of night periods the program requests the average grade and number of approaches for each period. The average grade for each period must be entered exactly as it appears on the FCLP Trend Analysis Form (which is output of the PADDLES program). Also, the number of approaches upon which the average grade was based must be entered.

If the operator does not wish to enter night FCLP average grades, an "N" may be entered and the program will then ask if day FCLP grades are to be entered. The operator responses for day FCLP requests are the same as the above requests for night grades.

Special care should be taken to ensure that grades for FCLP periods are entered exactly as printed and in consecutive order. That is, the average grade for FCLP period number one should be entered first, the grade for period number two should be second, etc. up to the number of FCLP periods that occurred. Furthermore, night FCLP must be entered in consecutive order and not intermixed with day FCLP grades and vice versa.

Following is an example of the data entry sequence and resultant output for the GRADER program; all program requests lines are indicated with a question mark (?) and data entered by the operator with a pound symbol (#). (These symbols are included in the figure for demonstration purposes, but do not occur in the actual program.)

```
 [illegible] TO APARTS-FCLP, AN AUTOMATED
 PERFORMANCE ASSESSMENT AND
 REMEDIAL TRAINING SYSTEM FOR
 FIELD CARRIER LANDING PRACTICE.


?ENTER STUDENT PILOT'S LAST NAME AND INITIALS.
#SMITH JR

?ENTER AIRCRAFT TYPE.  EX: A-7E
#A-7

?ENTER AIRCRAFT SIDE #.  EX: 412
#999

?ENTER TODAY'S DATE.  EX: 28AUG79 OR 08/28/79
#[illegible]

?ENTER SQUADRON.  EX: VA-174
#VA-999

?ENTER LSO'S LAST NAME AND INITIALS.
#JONES HR


?YOU HAVE ENTERED THE FOLLOWING INFORMATION:

 DATE: 1[illegible]79
 PILOT: SMITH J
 LSO: JONES HR
 ACFT TYPE: A-7
 ACFT SIDE #: 999
 SQUADRON: VA-999

?IF THE ABOVE INFORMATION IS CORRECT, ENTER Y.  IF NOT, ENTER N.
#Y


?DO YOU WISH TO ENTER AVERAGE GRADES
 FOR NIGHT FCLP PERIODS?
 IF YOU DO, ENTER Y.  IF NOT, ENTER N.
#Y


?ENTER THE NUMBER OF NIGHT FCLP PERIODS.
#8
```

Figure B-1. Example of GRADER Operator Instructions and Output. (Sheet 1 of 5)

```
? ENTER THE [illegible] GRADE FOR EACH FCLP
  PERIOD EXACTLY AS IT APPEARS ON THE
  FCLP TREND ANALYSIS FORM.
  I.E.   DATA SHOULD BE IN X.XX FORMAT.

? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  1
# 3.05

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  1
# 10


? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  2
# 2.75

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  2
# 8


? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  3
# 2.90

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  3
# 5


? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  4
# 3.1

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  4
# 10


? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  5
# 3.06

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  5
# 10


? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  6
# 2.71

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  6
# 10
```

Figure B-1. Example of GRADER Operator Instructions and Output. (Sheet 2 of 5)

```
? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  7
# 3.22

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  7
# 10


? ENTER THE AVERAGE GRADE FOR NIGHT FCLP PERIOD #  8
# 3.35

? ENTER THE # OF APPROACHES FOR NIGHT FCLP PERIOD #  8
# 10


? DO YOU WISH TO ENTER AVERAGE GRADES
  FOR DAY FCLP PERIODS?
  IF YOU DO, ENTER Y.  IF NOT, ENTER N.
# Y


? ENTER THE # OF DAY FCLP PERIODS
# 5


? ENTER THE AVERAGE GRADE FOR EACH FCLP
  PERIOD EXACTLY AS IT APPEARS ON THE
  FCLP TREND ANALYSIS FORM.
  I.E.   DATA SHOULD BE IN X.XX FORMAT.

? ENTER THE AVERAGE GRADE FOR DAY PERIOD #  1
# 2.90

? ENTER THE # OF APPROACHES FOR DAY FCLP PERIOD #  1
# 10


? ENTER THE AVERAGE GRADE FOR DAY PERIOD #  2
# 3.10

? ENTER THE # OF APPROACHES FOR DAY FCLP PERIOD #  2
# 8


? ENTER THE AVERAGE GRADE FOR DAY PERIOD #  3
# 2.95

? ENTER THE # OF APPROACHES FOR DAY FCLP PERIOD #  3
# 9
```

Figure B-1. Example of GRADER Operator Instructions and Output. (Sheet 3 of 5)

```
?ENTER THE AVERAGE GRADE FOR DAY PERIOD #  4
#3.14

?ENTER THE # OF APPROACHES FOR DAY FCLP PERIOD #  4
#10


?ENTER THE AVERAGE GRADE FOR DAY PERIOD #  5
#3.26

?ENTER THE # OF APPROACHES FOR DAY FCLP PERIOD #  5
#10


?HOW MANY COPIES OF THE OUTPUT DO YOU WANT?
#1
```

Figure B-1. Example of GRADER Operator Instructions and Output. (Sheet 4 of 5)

APARTS-FCLP:

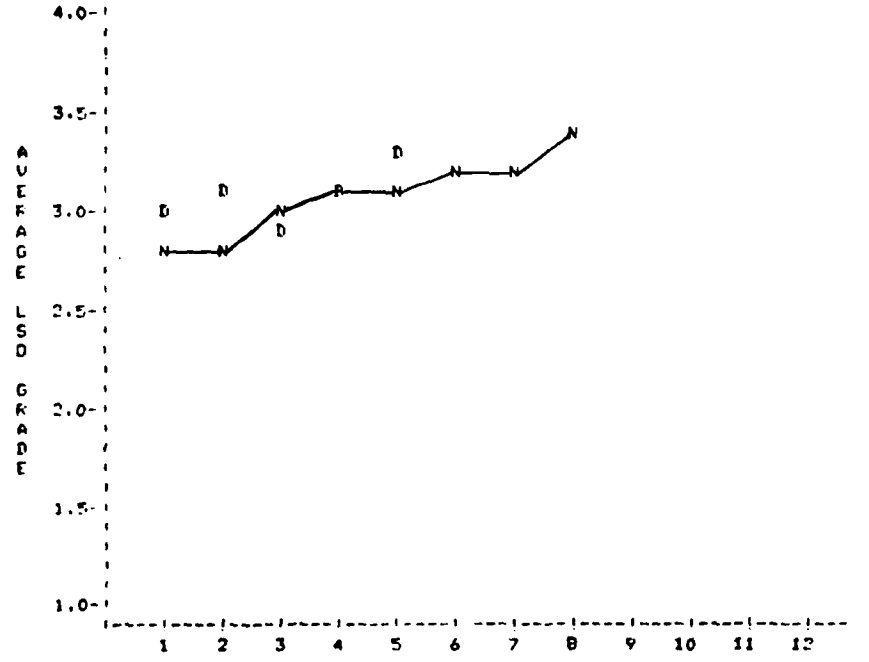
AUTOMATED PERFORMANCE ASSESSMENT
AND REMEDIAL TRAINING SYSTEM FOR
FIELD CARRIER LANDING PRACTICE

DATE: 16OCT79 # OF FCLP PERIODS: 8-NIGHT 5-DAY

PILOT: SMITH JT LSO: JONES HR

ACFT TYPE/SIDE #: A-7 / 999 SQUADRON: VA-999

FCLP PERFORMANCE GRAPH



	1	2	3	4	5	6	7	8	9	10	11	12
# OF NIGHT APPROACHES	10	8	9	10	10	10	10	10	0	0	0	0
# OF DAY APPROACHES	10	8	9	10	10	0	0	0	0	0	0	0

FCLP SUMMARY FOR PILOT: SMITH JT

NIGHT_FCLP	DAY_FCLP
AVERAGE GRADE = 3.07	AVERAGE GRADE = 3.08
TOTAL APPROACHES = 77	TOTAL APPROACHES = 47

NOTE: N = NIGHT, D = DAY AND B = BOTH NIGHT AND DAY AVERAGE LSO GRADES

DO YOU WISH TO ENTER DATA FOR ANY MORE STUDENTS?
IF YOU DO, ENTER Y. IF NOT, ENTER N.
N

STOP --

Figure B-1. Example of GRADER Operator Instructions and Output. (Sheet 5 of 5)

APPENDIX C
GLOSSARY OF LSO COMMENTS

GENERAL SYMBOLS*

Symbol	Meaning	Symbol	Meaning
WO	Waveoff	Square	A square drawn around any symbol indicates that a signal was not answered
OWO	Own waveoff		
TWO	Test waveoff	Circle	A circle drawn around any symbol indicates that a signal was answered too slowly
OK	Perfect pass		
OK	Reasonable deviations with good corrections	OC	When used as a prefix to any symbol, OC indicates "over-controlled"
(OK)	Reasonable deviations		
——	Below average but safe pass	A	APC/AUTO
C	Unsafe, gross deviations inside waveoff point	M	Manual (APC equipped aircraft)
B	Bolter	PD	Pitching deck
( )	Parentheses around any symbol signifies "slightly"; i.e., (F) means "slightly fast"	I	Mode 1 ACLS (record in grade column)

DESCRIPTIVE SYMBOLS*

AA	Angling approach	CD	Coming down
ACC	Accelerate	CLO	Close
AFU	All Fouled Up	CO	Come-on
B	Flat glideslope	COCO	Climbed on come-on
C	Climbing	CPD	Chased Pitching Deck
CB	Coming back to the left	CU	Cocked up

*Log symbols for this report were extracted from the Landing Signal Officer NATOPS manual.

DESCRIPTIVE SYMBOLS (Cont'd)

Symbol	Meaning	Symbol	Meaning
DEC	Decelerate	NERD	Not enough rate of decent
DFD	Dived for deck	NERR	Not enough right rudder
DLW	Dropped left wing	NESA	Not enough straight away
DN	Dropped nose	NH	No hook
DRW	Dropped right wing	NLU	Not lined up
EG	Eased gun	OS	Overshoot
F	Fast	OSCB	Overshot coming back
FD	Fouled deck	P	Power
GLI	Gliding approach	PNU	Pulled nose up
H	High	ROT	Rotate
LIG	Long in the groove	RUF	Rough
LLU	Late line up	R-L	Right to left
LL	Landed left	S	Settle
LO	Low	SKID	Skid
L-R	Left to right	SLIP	Slip
LR	Landed right	SLO	Slow
LUL	Lined up left	SRD	Stopped rate of descent
LUR	Lined up right	ST	Steep turn
ND	Nose down	TAR	Turned at ramp
NEA	Not enough attitude	TCA	Too close abeam
NELR	Not enough left rudder	TMA	Too much attitude
NEP	Not enough power	TMRD	Too much rate of descent

DESCRIPTIVE SYMBOLS (Cont'd)

Symbol	Meaning	Symbol	Meaning
TTL	Turned too late	.·.	Landed 3 points
TTM	Turned too much		Over the top
TTS	Turned too soon		Fly through the glideslope
TWA	Too wide abeam		Fly through the glideslope
——	For emphasis		

SYMBOL SUFFIXES

IT	In the turn	TL	To land
OT	Out of turn (as aircraft starts to roll wings level)	IW	In the wires
		OW	Over the wires
X	At the start (first 1/3 of glideslope)	AW	All the way
IM	In the middle (middle 1/3 of glideslope)		
IC	In close (last 1/3 of glideslope)		
AR	At the ramp		

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